

# Analyzing Power of Quasi-Elastic Proton-Proton Scattering at the Energies from 200 to 650 MeV/nucleon

Analyzing power of proton-proton quasi-elastic scattering was obtained at the Nuclotron Internal Target Station using a polarized deuteron beam and a polyethylene target. The selection of useful events was performed using the time and amplitude information from scintillation counters. The asymmetry on hydrogen was obtained using the process of the carbon background subtraction. The obtained analyzing power values are compared with the predictions of the partial-wave analysis SAID at the beam energies of 200, 500, 550, and 650 MeV/nucleon.

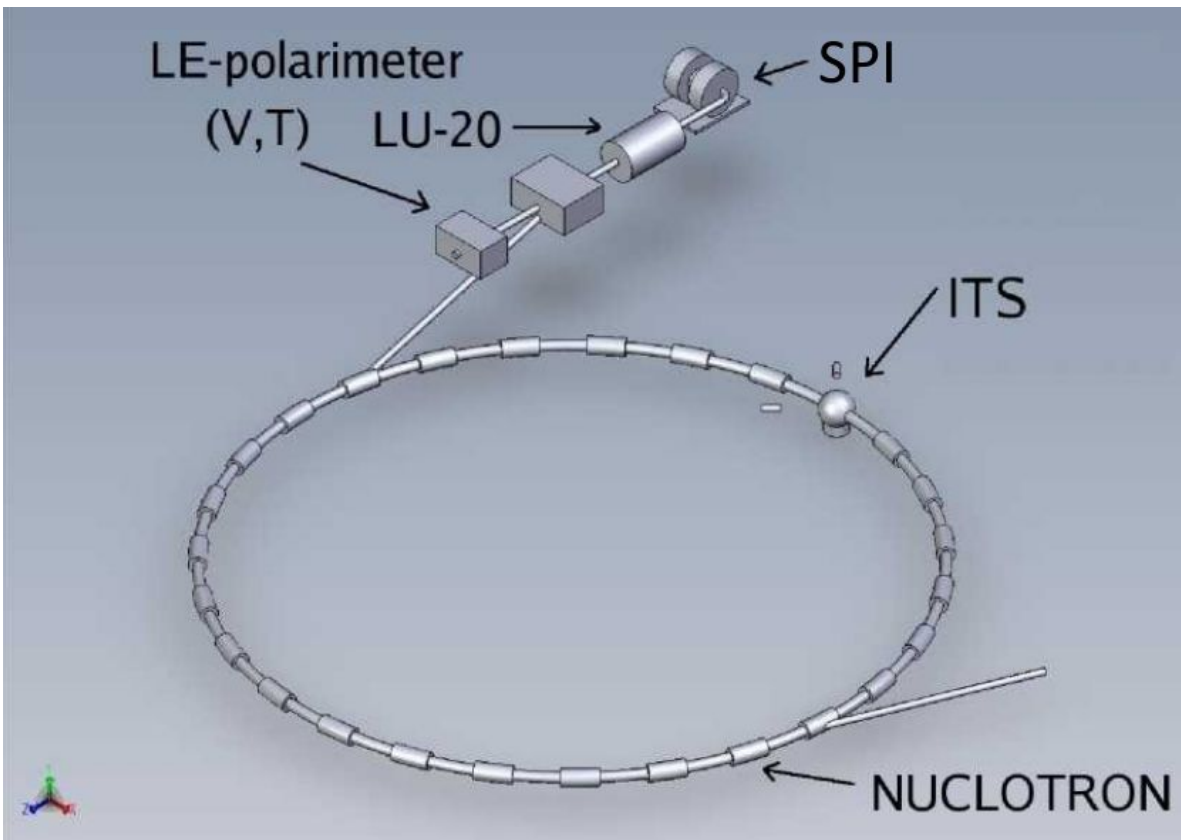
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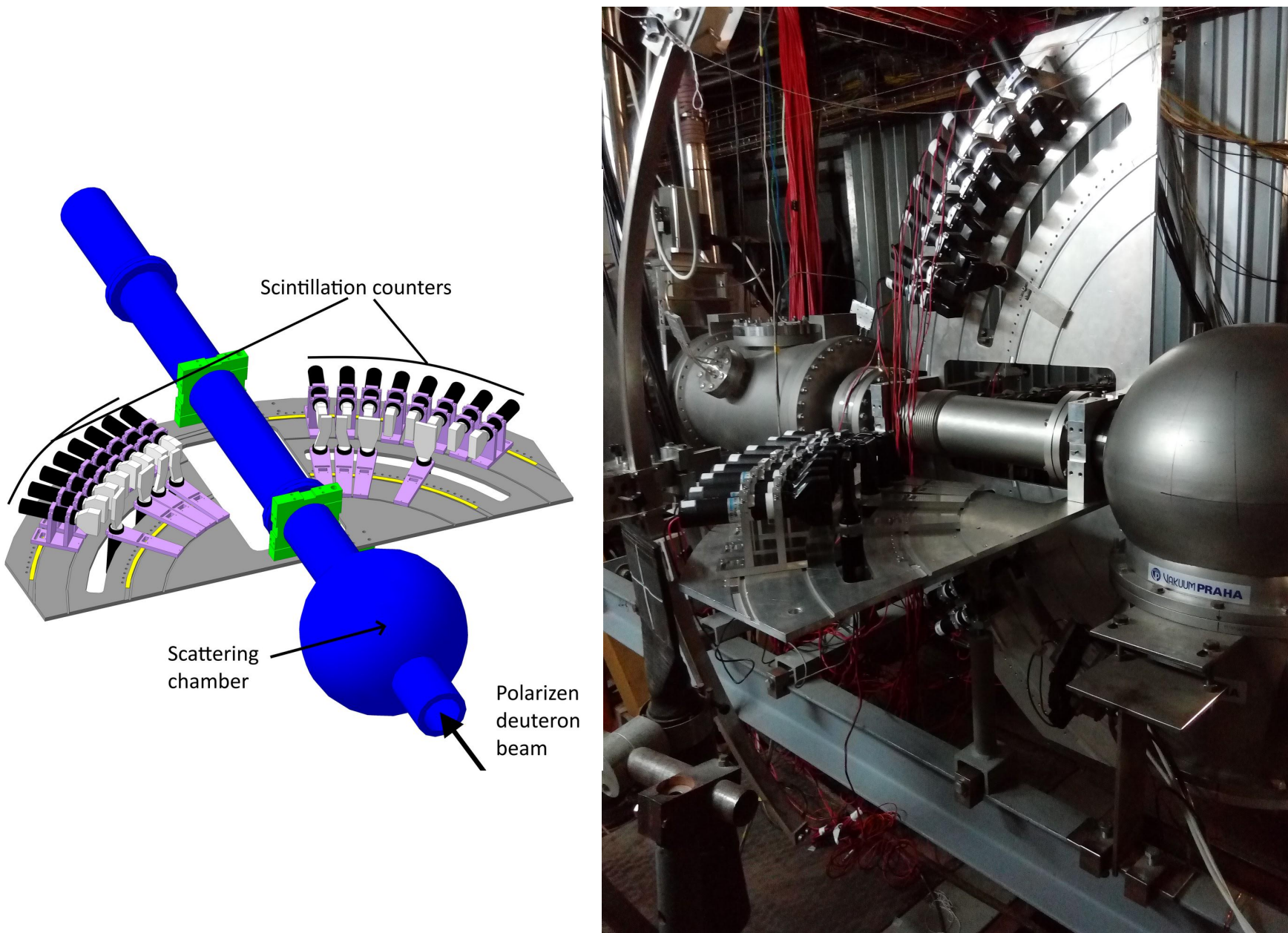
## The experiment

The experiment was carried out at the Internal Target Station of the superconducting synchrotron Nuclotron which is suited in the Laboratory of High Energy Physics of JINR in 2016 year. The deuteron beam for the experiment was provided by the source of polarized ions (SPI).

Scheme of the experiment at NUCLOTRON



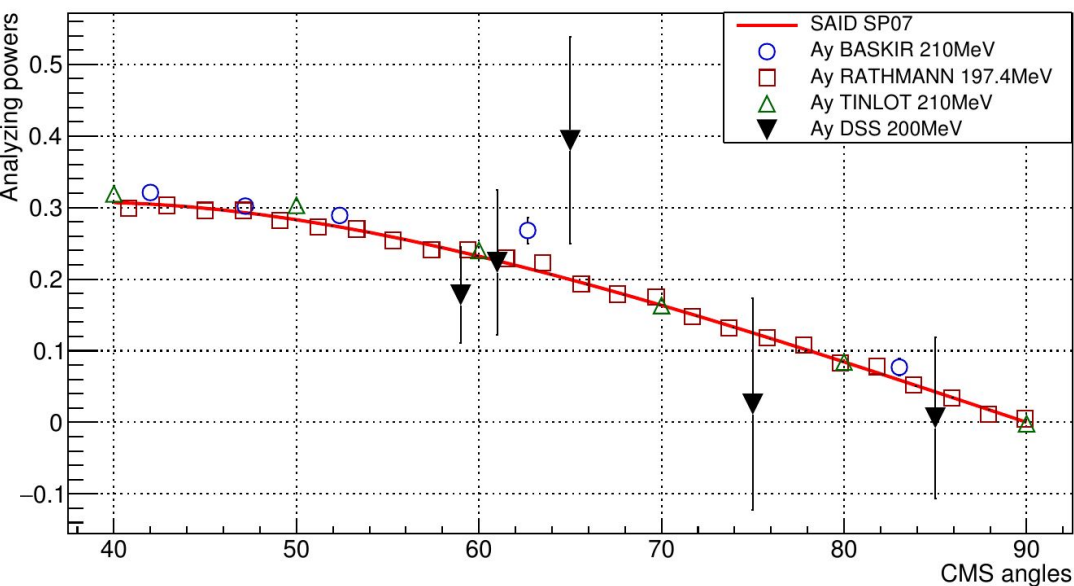
The DSS Setup



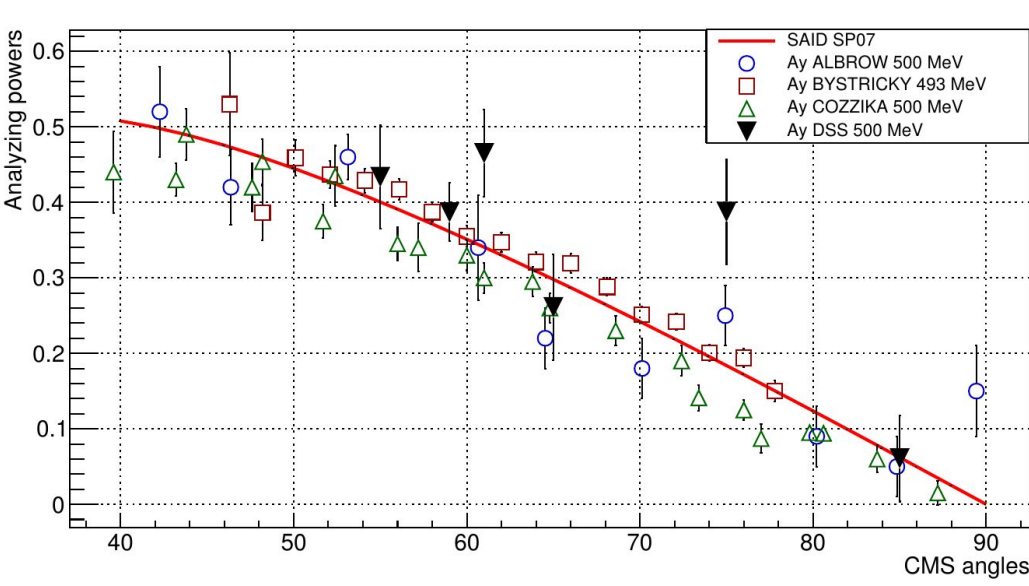
## The vector analyzing power

The vector analyzing power  $A_y$  for the proton-proton quasi-elastic scattering at the various deuteron beam energies are presented below. The full symbols are the results of the present experiment. The open symbols are the data, obtained in the other experiments.

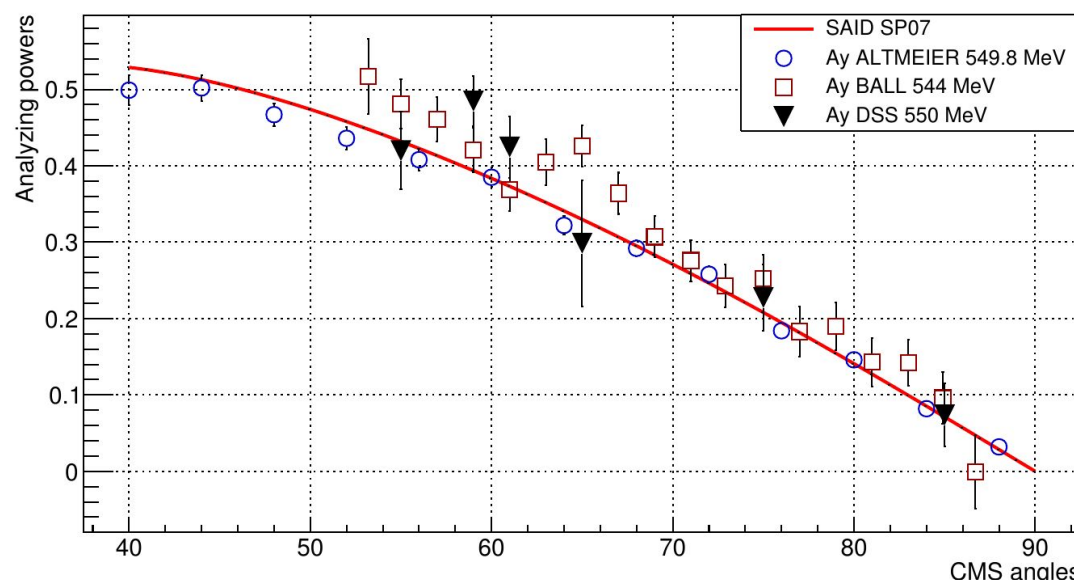
200 MeV/n



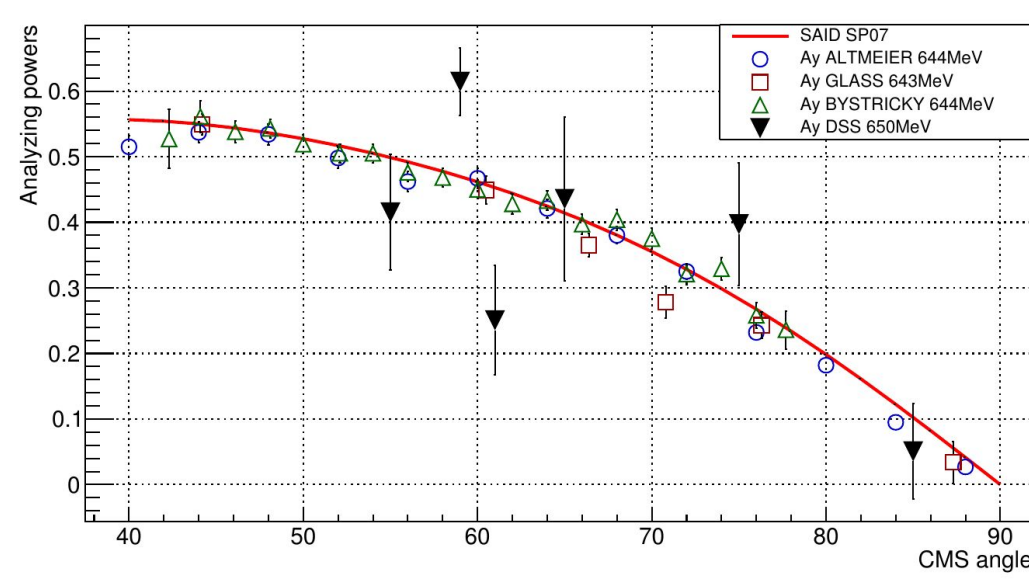
500 MeV/n



550 MeV/n



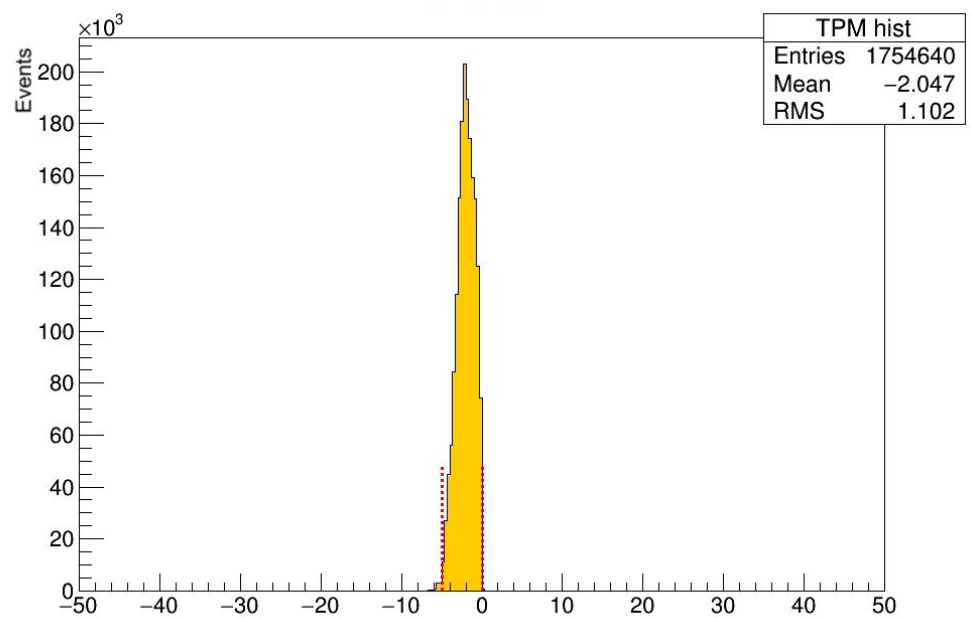
650 MeV/n



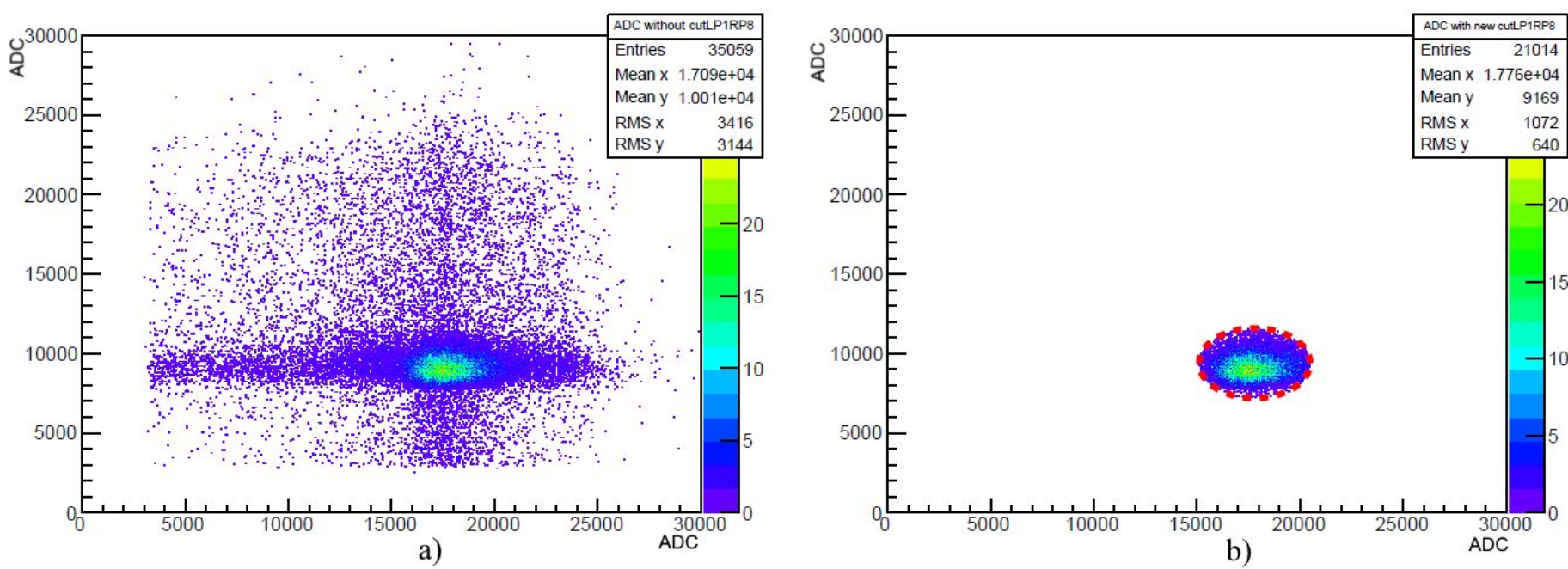
## Data analysis

The useful data were selected using criteria on the data for the time-of-flight difference between kinematically coupled detectors signals, for the energy losses correlation of the signals, and for the event interaction point obtained from the kinematically coupled scintillation counters.

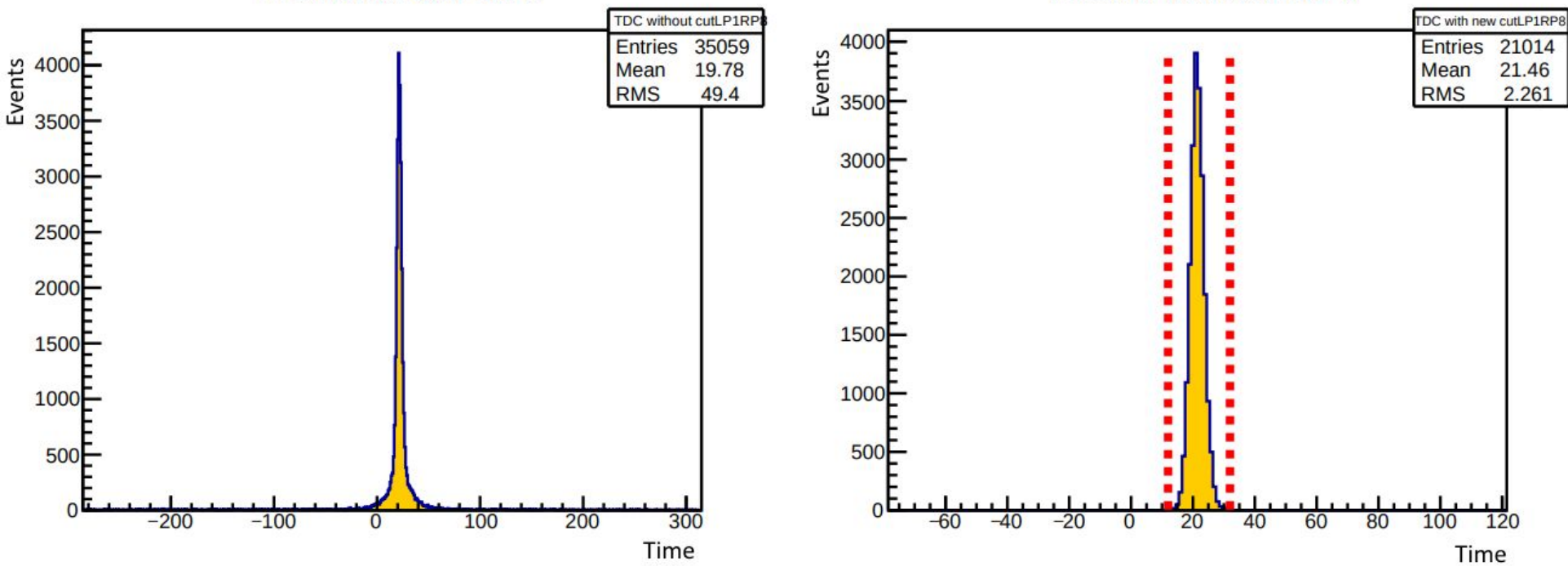
The dependence of the events yield on the position of the target



ADC correlation for the counters pair

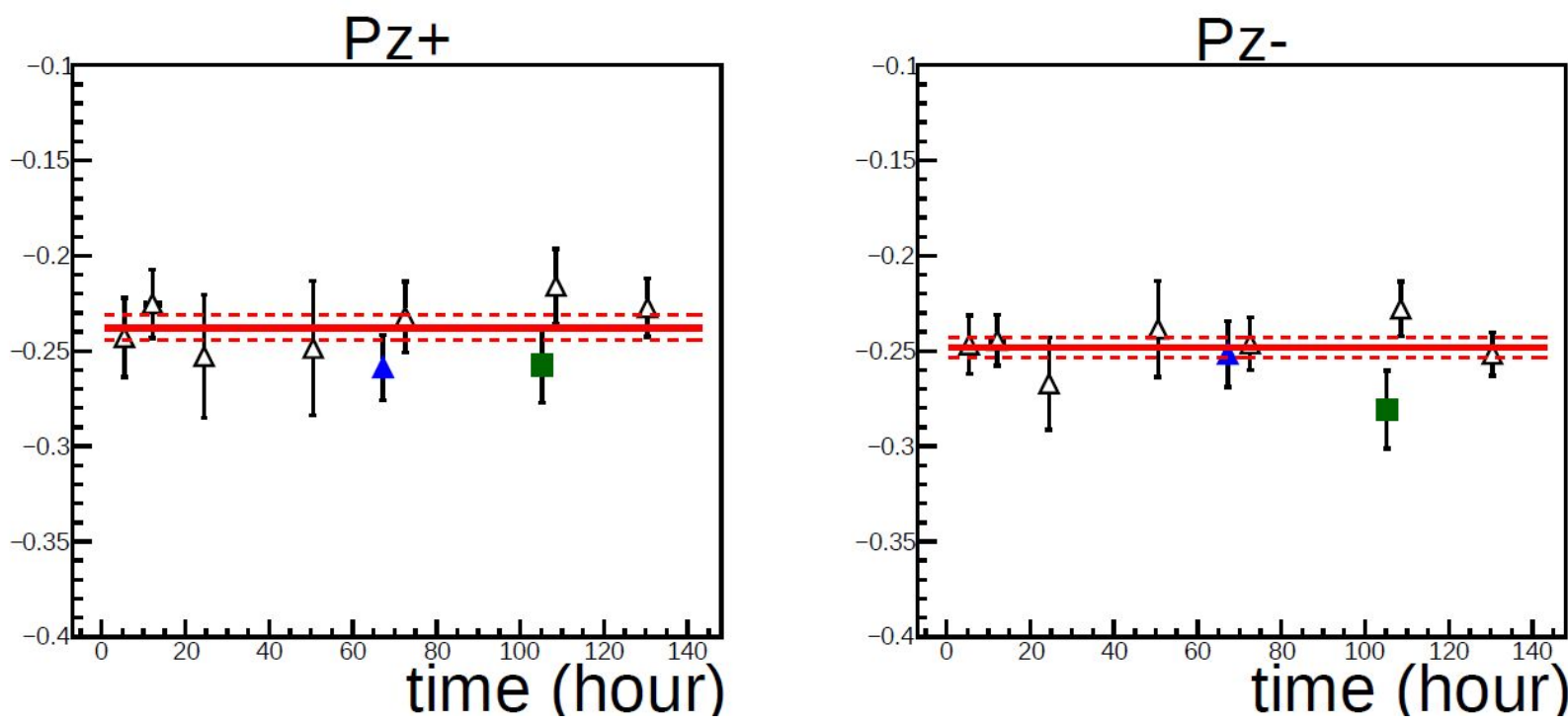


The time of flight difference for the counters pair



## The vector polarization values

The vector polarization values for the deuteron beam was measured at the energies of 500 and 650 MeV/n. The full markers are the data from the present experiment, the open markers are the data for the polarization obtained at the beam energy of 135 MeV/n.



△ - polarization values for dp elastic scattering (135 MeV/n)  
▲ - polarization values for pp quasi-elastic scattering (500 MeV/n)  
■ - polarization values for pp quasi-elastic scattering (650 MeV/n)

## Conclusion

- The vector analyzing power values of the pp-quasielastic scattering reaction were obtained at the deuteron beam energies of 200, 500, 550 and 650 MeV/n;
- The vector polarization values of the deuteron beam were obtained at the deuteron beam energies of 500 and 650 MeV/n;
- The vector polarization values are in good agreement with the polarization values that were obtained using dp-elastic scattering at the beam energy of 135 MeV/nucleon.

The new polamiter for the internal targets station is under developing. It is on stage of developing the new mechanical part and testing of the new scintillation counters.